The Product Safety Newsletter

IEEE

Vol 2, No. 1 January-February 1989

Chairman's Message

It seems hard to believe, but here we are, at the beginning of another new year. Reflecting back on 1988, I have to say that the Product Safety Technical Committee had a good year. Indeed, a revolutionary year.

We entered 1988 as a newly formed, single chapter of a group, calling ourselves the Product Safety Society. We had developed a charter, a strategy to implement the charter, and had established a set of organizational objectives (to affiliate with the IEEE, remember?). Enthusiasm was in the air.

In February, the fIrst issue of our newsletter was published and distributed to about 150 people. Also in February, a second chapter was formed in the Northwestem U.S.

By July, the newsletter circulation had exceeded six hundred. Four chapters were active nationwide.

In August, the first step in our quest for becoming an IEEE Society was realized as the IEEE EMC Society Board of Directors voted to allow us to affiliate with their group as the Product Safety Technical Committee (PSTC).

At their November meeting, the IEEE EMC Society Board of Directors approved our Committee Scope (see next page) and confirmed our officers.

The end of December saw us with a newsletter circulation of greater than eight hundred, a growing organization, and a need for revenue and volunteers.

Enthusiasm is still in the air. The PSTC is still growing at a rapid rate. Several new local groups are in the formation stages. One (in Chicago) has set a date for its first meeting.

But, *your* help is still needed. We specifically need volunteers to serve as the Symposium Liaison Chairman and the Standards Liaison Chairman. These positions are critical and need to be filled immediately. In addition, we need volunteers to serve on various committees. *Your* contribution is required for our group to be successful. Please call, write, or send a fax to one of the officers with *your* area of interest.

We are also still in need of revenue to help support the newsletter, which is our single biggest expense. We are looking at various ways to generate funds and to lower our costs.

Some ideas to fund the newsletter are to solicit contributions (contributors will be recognized in the newsletter), obtain funds from the EMC Society, obtain funds from the individual chapters, and charge a fee for the newsletter. These, as well as other thoughts, are under consideration. Your suggestions will be appreciated.

The year 1989 will no doubt bring about new challenges. But your officers and committee chairmen, with your help, are ready to meet these challenges and to continue our efforts to "... advance the awareness of product safety..."

Best wishes for a prosperous year.

Rich Pescatore, *Chairman*

The Product Safety Newsletter

Vol 2, No 1 January/February 1989

 Comments and questions about the newsletter may be addressed to the *Product Safety Newsletter,* Attention: Roger Volgstadt, c/*o* Tandem Computers, 2550 Walsh Ave., Santa Clara, CA 95051-1392, Fax No. (408) 748-2137.

This newsletter is prepared by the Corporate Graphics Group of Tandem Computers Incorporated. The editor wishes to extend a special thanks to Annie Valva and Jodi Elgin of Tandem Computers for their work in preparing this newsletter.

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Product Safety Technical Committee Scope

The following is the PSTC Scope that was approved at the November 16,1988 *meeting of the EMC Society Board of Directors meeting.*

Committee Scope:
The TC on Product Safety is concerned with the electrical safety (both direct and indirect) of electronic products. The Committee strives to advance the knowledge and awareness of product safety through:

- Study of product safety engineering principles and applications, including those related to EMC.
- Promotion of consistent understanding and interpretation of applicable product safety standards.
- Understanding of the contribution to product safety of the test house.
- Understanding of the certification processes.
- Review of emerging standards.
- Study of the implementation of product safety principles within organizations.

It is anticipated that the Committee will carry out the above through enhanced communications and education. The following methods may be used to this end:

- Sponsor presentations and panel discussions by technical experts.
- Publish pertinent papers and articles in IEEE publications, including the EMC Society Newsletter (in cooperation with the appropriate editors).
- Publish a periodic newsletter.
- Prepare and review papers relating to the safety of electronic products for presentation at EMC symposiums.
- Provide safety engineering information to standards writing groups within the society and other organizations.
- Provide information based on industry practices to certification agencies.

Technically Speaking

Rich Nute

Thermocouples and Temperature Measurement

Hello from Vancouver, Washington, USA:

One of our members suggested I write about thermocouples and temperature measurement. Textbooks have been written on this subject; I can only give a broad overview of the subject. Since temperature measurement is indigenous to every safety evaluation, perhaps I can demystify some of the rules applied by the various certification houses.

Disregarding accessible hot pans, why do we measure temperatures, and how do we decide what pans should be measured? What is the hazard that is prevented, controlled or limited as a result of measuring temperatures within electronic equipment? Why do we measure temperature rise rather than absolute temperature?

Why do we use thermocouples rather than other temperature measuring devices? And, how do thermocouples work?

Thermocouple Theory

Let's tackle this last question first. According to ANSI MC96-1, a thermocouple is "two dissimilar thermo elements so joined as to produce a thermal emf when the measuring and reference junctions are at different temperatures."

This definition has three critical concepts in it: "thermoelements," "thermal emf," and "junction." The most critical concept is that of "thermal emf."

In 1821, Thomas Johann Seebeck discovered that, in a closed circuit made up of two dissimilar metals (thermoelements), electric current will flow *if* the temperature of one junction is elevated above that of the other. This phenomenon is known as the "Seebeck effect." (See Figure 1.) The "circuit" comprises a thermocouple. All dissimilar metals exhibit this effect.

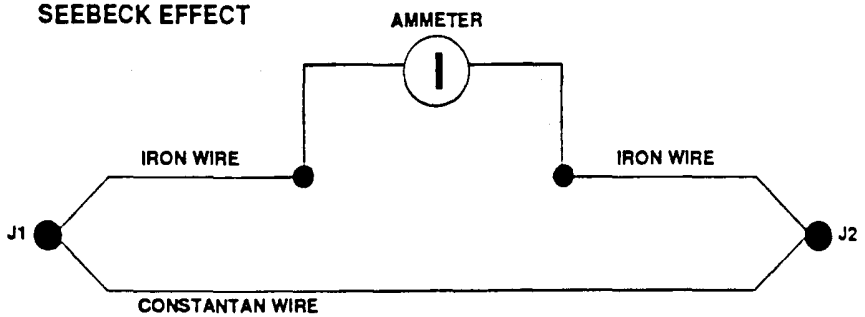
Note that every wire has two ends. When connected into a circuit, every wire has two junctions, one at each end of the wire. Where a junction involves dissimilar metals, the wires become thermoelements. Where both junctions involve dissimilar metals, the system becomes a thermocouple where one junction is the "measuring junction," and the other end is the "reference junction."

Each thermoelement junction generates a voltage (thermal emf), proportional to temperature. When the two thermoelement junctions are at the same temperature, the thermal emf's are equal, and there is no current in the circuit. When the temperature of one junction is higher or lower than the other junction, the ammeter will indicate a current which is proportional to the temperature difference between the two junctions and to the areas of the junctions.

(The tricky pan of the system is to connect the meter in such a fashion as to neutralize the effect of nonmeasuring junctions of dissimilar metals. More about this later.)

Continued

FIGURE 1
SEEBECK EFFECT



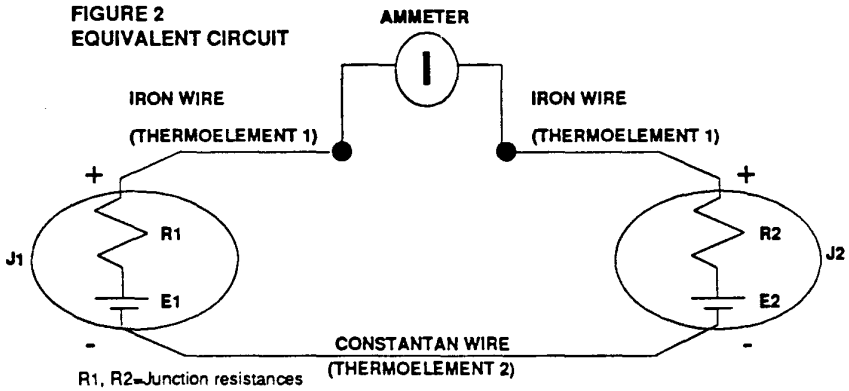
J1-Measuring Junction at unknown temperature
J2-Reference Junction at known temperature
I-Current proportional to temperature difference between J1 and J2

Figure 2 is an equivalent circuit to Figure 1. Each junction can be represented by a battery and resistor in series. In Figure 2, thermal emf's Eland E2 are a function of the combination of different metals and proportional to the temperatures of the junctions. Resistances R1 and R2 are proportional to the area of the respective junctions.

In Figure 2, I is proportional to the temperature difference between Junction 1 and Junction 2. But I is also proportional to the values of R1 and R2. The values of R1 and R2 are proportional to the areas of the junctions, which are neither predictable nor repeatable. Therefore, while I is proportional to the temperature difference, it cannot be used to determine temperature difference unless the values of R1 and R2 are determined and accounted for.

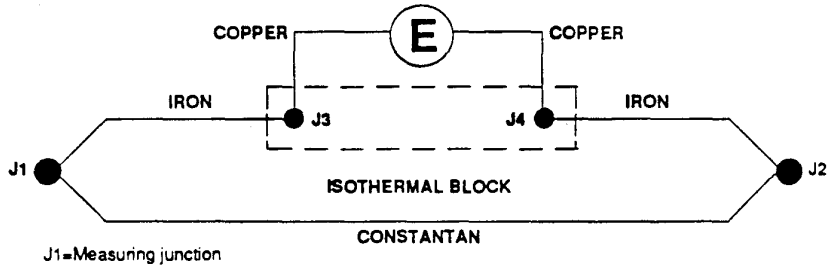
We can eliminate the effects of R1 and R2 by replacing the ammeter with a voltmeter. See Figure 3. The voltmeter measures the voltage difference E + E 1 - E2, between the two junctions. If we know the temperature of the reference junction, then we can determine the voltage E2 by looking up, in tables, the voltage that corresponds to the reference junction temperature. Now, we can solve the equation E1 = E + E2. We now go back to the tables and look up E1 and its temperature, which is the measuring junction temperature.

FIGURE 2
EQUIVALENT CIRCUIT



R1, R2=Junction resistances
E1, E2=Thermal EMF

FIGURE 3
A PRACTICAL THERMOCOUPLE THERMOMETER



J1=Measuring junction
J2=Reference junction
JR, J4=Copper-iron voltmeter junctions

If the reference junction temperature is at 0 deg. C (in an ice bath), then, since the voltages in the tables are referenced to 0 deg. C, E2 = 0, and E = E 1. Now, we can eliminate the summing step, and just read the temperature directly from the tables.

Voltmeter Junctions

Now the question: How do we deal with the connection (junctions) of the iron wire to the copper wires of the meter? Recall two statements: First, all dissimilar metals exhibit the Seebeck effect. Thus, the connection from the iron wire to the two copper wires constitutes another thermocouple. Second, when two junctions are at the same temperature, the thermal emf s are equal, and there is no current in the circuit. So, we put the two iron-copper junctions on an isothermal block so that the temperature of one junction is the same as the temperature of the other junction. (See Figure 3.) Thus, the two

Continued

additional junctions cancel out, and do not connibute to the measurement.

Reference Junction Temperature
The temperature of the reference junction needs to be determined. There are several ways to do this.

First, we can force the junction to a particular temperature. The most obvious is the ice bath. But this is cumbersome.

Or, second, we can put the reference junction onto an isothermal block and measure the temperature of the block by some other means. This is commonly done with a thermistor.

Or, third, we can use a battery and thermistor circuit to generate the same voltage as if the reference thermocouple was at 0 deg. C. This is the "electronic ice point."

In each case, and possible after some intermediary steps, the result is the voltage (proportional to the temperature) of the measuring junction. The next step is to convert the voltage to a temperature.

Voltage-to-Temperature Conversion
First, we can simply look up the voltage in a table, and read the corresponding temperature. This could be done either manually or with an electronic memory.

Or, we can calculate the temperature from an equation of the relationship between voltage and temperature.

Or, we can assume the voltage-to-temperature relationship is linear, measure voltage, employ a scale factor, and read out temperature (with some inaccuracy).

(The voltage-to-temperature relationship of a thermocouple is not linear. The Type K thermocouple approaches linearity over a temperature range of 0 to 1000 deg. C and is the thermocouple of choice for use with a scaling voltmeter.)

Fortunately, most modern-day thermocouple measuring equipment addresses all of these parameters so that we need not concern ourselves with meter junctions, isothermal blocks, reference junctions, reference junction temperature, voltage-to-temperature relationship, or nonlinearity. We need only apply the thermocouple or probe to the object and read temperature.

Thermocouple Types
There are many different thermocouple types, and the more common types have been standardized by letter designation and color coding of wires, connectors, and isothermal junction blocks. Certification houses have standardized on the Type J thermocouple because it is inexpensive and, therefore, popular and readily available, and it has a suitable temperature range.

Despite this standardization, mixups occur. A cup of ice water will not show a mixup of thermocouple types since, by convention, 0 deg. C corresponds to 0 V for all thermocouple types. Instead, a cup of boiling water confirms whether the system is homogeneous and calibrated.

Thermocouples vs. Other Thermometers
Why do we use thermocouples rather than other temperature-measuring devices? Certainly one of the reasons is that thermocouples have been around for a long time and are well-characterized in their performance. By standardizing on one particular system, thermocouples, one of the variables in temperature measurement is eliminated. Thermocouples, in general for safety evaluation, have relatively low thermal mass compared to the part being measured. This is necessary because a thermocouple *always* takes heat away from the object being measured, and lowers the temperature by some amount. To minimize this error, we use the smallest thermocouple practicable for the particular measurement. CSA, for example, specifies No. 30 A WG thermocouple wire with a welded junction.

Thermocouple Attachment
The attachment of the thermocouple to the part to be measured is also

Continued

critical to an accurate temperature measurement. The thermocouple junction must be in direct contact with the pan or material being measured. This means that, if epoxy cement is used to attach the thermocouple, there must be no cement between the thermocouple and the pan. Otherwise, there is a temperature gradient through the cement. The thermocouple will measure the temperature at its location within the epoxy which will, necessarily, be less than that of the pan being measured.

In some cases, the epoxy or other attachment means may act as a thermal insulator for the pan such that the temperature measured by the thermocouple is actually higher than the temperature without the epoxy or other attachment means.

The general rule is: use the least amount of material practicable for attaching the thermocouple to the pan.

Hazards

What is the hazard that is prevented, controlled, or limited as a result of measuring temperatures within electronic equipment? This is not at all intuitively obvious, nor is it obvious from a study of the various certification-house standards. We begin to get an idea of the hazard from the title of Clause 7.2 of IEC 348, "Safety Requiremerments for Electronic Measuring Apparatus." The title: Preservation of Insulation.

The principal objective of temperature measurement is to determine that all safety-related insulations are used within their temperature ratings. When this is accomplished, we can be assured that the insulation is not unduly stressed by the temperature imposed upon it, and that, therefore, it will be "preserved." A fundamental assumption is that if the insulation is used within its temperature rating, it is not likely to fail--- that is, it is preserved --- for its lifetime.

The hazard that is prevented is that hazard that would result from the failure of the particular insulation. Often, insulation failure results in conditions for electric shock. Insulation failure in electronic equipment may also result in electrically-caused fire.

Measurements

Now we can begin to decide what pans should be measured. Obviously, we measure all safety-related insulations. This would include transformers, inductors in mains circuits, printed wiring boards, switch bodies, thermoplastic-insulated wires, etc.

But, in a transformer, we measure the wire temperature, not the insulation temperature. Why? The wire temperature heats the insulation, and since the wire is in intimate contact with the insulation, the wire temperature is the worst-case insulation temperature. And, most electrical insulators are also thermal insulators, so measuring the hottest spot on the insulation is difficult, if not impossible.

In some standards, we are required to measure semiconductor devices and resistors. Why do we measure these components since they are not a safety insulation? We do so because wire insulation could come in contact with the devices and be burned.

We also measure polymeric materials and capacitors. Polymeric materials are used as enclosures and structures. Here, too, the material must be "preserved" to retain its enclosing and structural functions; preservation is accomplished by using the material within its ratings.

Electrolytic capacitors are subject to explosion if the temperature is too high, so we measure their temperature. However, most of today's modem capacitors are provided with pressure relief mechanisms, but the requirement hangs on. X and Y capacitors are essentially across-the-line and line-to-ground insulations which must be used within their temperature ratings if the insulation is to be preserved.

Temperature Rise

Why do we measure temperature rise rather than absolute

Continued

temperature? This is a difficult question based on the preceding discussion. In the preceding discussion I implied that each material, whether insulation, polymeric material, or electrolytic capacitor, will fail to perform its function at some absolute temperature. If our objective is to obviate failure by operating insulations, polymeric materials, electrolytic capacitors, etc., within their ratings, then we should be concerned with absolute temperatures.

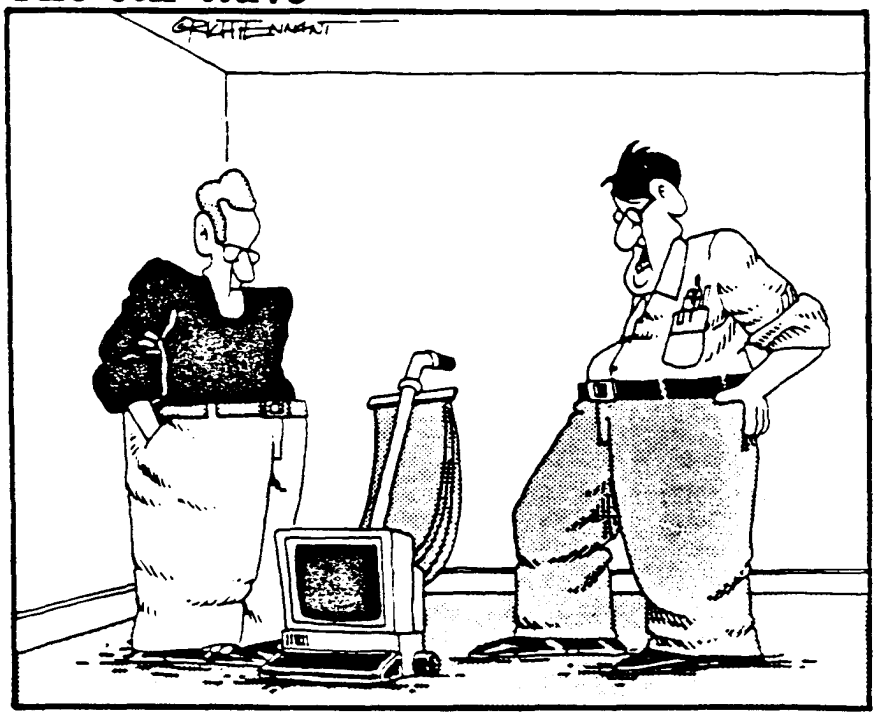
The problem with absolute temperature is that if we should measure temperature in a 20 deg. C environment, and someone else should measure temperature in a 25 deg. C environment, then our measurements may show acceptable performance, while their measurements may show unacceptable performance. But, if we subtract the ambient temperature, we both will get very nearly the same number.

The temperature-rise limits specified in standards are conservative when compared to rated temperatures of insulations, etc. And, they assume that the ambient temperature will be in the neighborhood of 20 to 25 deg. C. For example, a typical Class 105 insulation is allowed to rise 65 deg. C. So, if ambient is 25 deg. C, the absolute temperature is 90 deg. C, comfortably below the 105 deg. C rating.

Temperature-rise measurements and limits are used for the purpose of standardizing measurements between parties when the ambient is not closely controlled.

Due to space limitations, I have covered only a limited number of details within this subject. My selection of subjects is based on my personal experiences (or, rather, problems) encountered in temperature measurement and the use of thermocouples. Those with extensive background and experience may feel that I have omitted important points; if so, they are invited to make those points known in letters to: *Editor, Product Safety Newsletter, c/o Tandem Computers. 2550 Walsh Ave.. Santa Clara. CA 95051-1392.*

The 5th Wave



"IT STARTED OUT AS A KIT, AND WHILE I WAS WAITING FOR PARTS, THEY MERGED WITH A VACUUM CLEANER COMPANY."

News and Notes

by Dave Edmunds

Newsletters

There are several newsletters that may be of interest to a product safety engineer. Subscription information is included.

TUV Rheinland *Product Safety News* is a publication prepared by TUV Rheinland Group Asia which includes a listing of German safety standards. Copies are available from offices of TUV in Japan, Taiwan, Korea, or Hong Kong. No information is available on cost or frequency of publication. Only an address for the Hong Kong office is listed here: TUV Rheinland Hong Kong Ltd., Suite 2906, 29th Floor, Three Exchange Square, 8 Connaught Place, Central Hong Kong.

VDT News is a bimonthly publication that lists items on VDT safety and ergonomics. Cost is $87.00 per year from *VDT News,* P.O. Box 1799, Grand Central Station, New York, NY 10613. The editor is Louis SeIsin, Ph.D. Some items of interest in the latest issue include: a status of the preliminary injunction prohibiting enforcement of the VDT law issued by Suffolk Co.; the status of VDT state and local laws or documents with names and addresses to contact for more information; and a summary of NIOSH workshops on ergonomics and VDTs.

Product Safety Letter is a weekly publication that has summaries of the activity of the Consumer Product Regulations. Circulation information is from Consumer Product Regulations, 117 N. 19th St., Arlington, VA 01798, phone (703) 247-3433.

IEC Bulletin is an IEC publication summarizing the various activities of the IEC. Included are a calendar of events, committee report, status of six-month ruled documents, and recent published documents. The *IEC Bulletin* yearly subscription is Fr 21 for ordinary mail or Fr 30.50 for airmail from mc, 3 Rue de Varembe, P.O. Box 131, 1211 Geneva 20, Switzerland.

Readers' Feedback Wanted

This is the third appearance of this column, and we are seeking input from the readers. Does this column contain information that is interesting? Please advise us if there are other types of information that you would find interesting. If you know of any periodicals that deal with product safety, please send us their addresses. If you have ideas, suggestions, information you want published, or wish to assist or supply material, please contact Dave Edmunds, Xerox Corp., 800 Phillips Rd., MS 834-16S, W. Webster, NY 14580 or phone (716) 422-2380.

Laser Standard

Two additions to the Z136 series of Laser Safety documents have been approved by ANSI and published by Laser Institute of America (LIA), 5151 Monroe St., Toledo, OH 43623. These are Z 136.2 "for the safe use of optical fibers communication system utilizing laser diodes and LED sources" and Z136.3 "for safe use of lasers in health care facilities." The MPL in these documents is from Z136.1.

News and Notes

Continued

New European Approach to Standards
The NBS (?) has issued a document entitled "A Summary of the New European Community Approach to Standards." This publication (NBS 88-3793-1, issued August 1988) summarizes the IEC plans to achieve an "international market" and the standard related implementation on U.S. exporters.

IEEE-25 Years
A special issue of IEEE *Spectrum* (Vol. 25, No. 11) highlights the 25 years of publication of the *Spectrum,* starting January 1964. This issue, rather than emphasizing the history and origin of the publication, looks at the events and engineers in this time period. If you are not an IEEE member, borrow a copy. You will find it interesting and informative. Presently, the IEEE has 35 Societies and over 30,000 members.

Fiber Optics
The topic of fiber optics is changing and growing to coordinate the planned objectives on a national and international basis. There is a Fiber Optics Coordination Committee (FOCC) under ANSI. All U.S. organizations that have the concern or responsibility of developing standards on fiber optics are members of the FOCC. The IEEE is represented by Mr. Rautio, Chairman of IEEE Standards Coordinating Committee 26, Photonics.

Quick Connect Terminal Ground Connections
CBEMA has written a request to UL with proposals to permit the use of quick disconnect terminals for ground connections. A meeting between UL and interested CBEMA members is to be scheduled to discuss the applicability of this topic.

Product Safety Signs and Labels
An ANSI draft document Z535.4 (first edition, February 1988) establishes design guidelines for safety signs and labels as applicable to a product. This work is part of the Z535 series for documents on "Safety Signs and Colors." Others in the series are Z535.1, "Safety Color Code," Z535.2, "Environmental and Facility Safety Signs," and Z535.3, "Criteria for Safety Symbols." This document has different requirements from those in IEC 950.

Canadian Radio Interference Regulations
The Canada Gazette, Part II, dated September 28, 1988, has amendments to the Radio Interference Regulations C.R.C.

Canadian Standards Position on Surface Mounted Components
From CSA, the following position statement was recently issued to one of our readers: "The following guidelines have been given to CSA Engineers in the Information Processing and Business Equipment Group. These guidelines apply only to primary circuits and high voltage secondary circuits where failure of the solder mounting could be expected to cause a hazard:

Surface Mount Components: When used, surface mounted components shall require an adhesive (epoxy type) which withstands wave soldering to hold the component in place. The adhesive should be suitable for high temperatures present during the wave soldering and should not evaporate. In addition, these components should not come off or dislodge during abnormal tests, especially if they are only two- or four-pin devices."

Ask Doctor Z

In the world of Product Safety and Certification, there are many pitfalls for the unwary. If you have a problem that seems insoluble, then it's time to ask Doctor Z! *He has the answers, derived from his many years of training and experience in the Science of Product Safetiology. Pitfalls hold no terrors for Dr.* Z, *since he is on a first name basis with most of them. Any resemblance to persons, places, products, agencies, or good advice is purely coincidental, but don't let that stop you. Write to Dr.* Z *today.*

Dear Dr. Z,
If all this engineering stuff is so good, why aren't we doing it already? Could it be we are doing it, only you can't recognize it????
Signed,
"Not one of your biggestfans"

Dear Fan,
Are you sure this shouldn't be addressed to the "Technically Speaking" column, or even a letter to the editor???

Oh well, never one to miss an opportunity to expound, Dr. Z will hazard a response.

First, Dr. Z may be guilty of missing present day safety engineering work, Dr. Z would be more than happy to be set straight in this regard. For the most part, most of the safety engineering work appears (from my limited view) to be happening in some of the IEC Pilot functions, but they too in many instances seem to be getting sidetracked.

The standards writing processes are guided by two major forces. The first is the consensus requirement for standards writing that lets coalition building be a more powerful force than data. The second are certification processes which are outside of the standards committee control. In this latter case, there is a strong tendency to "maneuver" the requirements to avoid penalties from the certification process. Hidden agendas thrive under this environment. Most of the effort is spent addressing "issues" that exist because the original requirement was poorly researched and constructed. A politically expedient fix is searched for to 1) fix whatever, and 2) create no impact on previously certified products. This approach generally prevents the root problem from being discovered and eliminated. Instead, various patches are applied over time until no one really knows what hazard is addressed by the requirement, or to what degree the requirement provides protection from the hazard.

There is no doubt that safety standards are an important part of our world. So are third party safety certifications. The number of product standards and requirements are increasing, as are certifications. This great rate of change does create problems for us all, and if the system is to really provide the service it intends (safe products), then more engineering rigor must be injected into the processes. Otherwise we will find ourselves working harder and harder to meet requirements that have less and less to do with real safety.

A number of organizations provide information and services related to satisfying today' s requirements. The PSTC, rather than entering into the existing fray, could make a real contribution toward getting engineering back into the standards writing processes by focusing on hazards, their sources, protective mechanisms and limit values. The PSTC charter and strategy certainly support such an approach.

Well, Dr. Z didn't really answer your question, but trusts the response provides one possible explanation of why safety engineering is so hard to find in the electronic product safety field, and provides an opportunity for you to participate in constructive change.

Dr.Z

Area Activity Reports

Santa Clara Valley Chapter
Brian Claes opened our last meeting in November by introducing the new Santa Clara officers.

Due to a death in the family, the scheduled speaker, Serge Bousquet of CSA, was not able to make his presentation. Dave Adams of Hewlett-Packard, with 24-hour notice, volunteered to present a slide and talk show on IEC adoption status. According to Dave, by 1992, Europe will adopt international standards which all common market countries will accept. He also discussed how an IEC standard is adopted vs. an ANSI standard.

The Santa Clara Valley Chapter is looking for a restaurant near the meeting place to get together for pre-meeting attitude adjustment and dinner. Please call Mike Campi with your suggestions at (408) 773-0770. Presently, you may find a few members quaffing a brew at the Togo's on De Anza Boulevard before each meeting.

Serge Bousquet of CSA will be the guest speaker at our next meeting, Tuesday, January 24, 1989, at 7:00 p.m., at Apple Computer, 20525 Mariani Ave., Cupenino, on the comer of De Anza Blvd. (just south of Highway 280). Serge will discuss several topics relating to CSA activities and standards (including discussion of CSA developing a 950 based standard) and, of course, will be available for questions.

Questions regarding the Santa Clara Valley Chapter may be addressed to Mike Campi at (408) 773-0770.

Southern California Chapter
Minutes for the meeting of Tuesday, December 6, 1988.

At the last meeting of the Southern California Chapter, Mr. Larry Todd, Division Manager of ETL, gave a slide show and presentation on ETL's services which are available as an alternative to UL services. Following this presentation, the UL requirements for conductive coatings of plastics were discussed.

Tom Radley explained how the standard J type thermocouples can lead to large temperature errors when used on switching magnetics. Type T should be used instead to avoid iron as a thermocouple element.

A CSA bulletin 1402C on power supplies and a September 15, 1988 bulletin on IEC 950 testing were passed out. Problems in using the Recognized Component Directory to identify manufacturer's identification were discussed. One idea for improvement was to include the file number for nonalphabetical sections of the directory by manufacturer's name.

Canada now has marking requirements similar to the USA FCC requirements. Equipment imported into Canada after January 31, 1989, must comply and be labeled. The Canada Gazette, in its September 28, 1988 issue, published these requirements. For further information contact: Canadian Department of Communications, Garth Roberts, Director, EMC Analysis and Consultation Engineering Programs Branch, 300 Slater Street, Ottawa, Ontario K1A 0C8, phone (613) 990-4716.

A draft checklist in use at *TUV-R* forEN60950 was passed out. TUV-R would appreciate comments sent to their San Ramon office. TUV-R might consider opening a small Orange County office if it would be used enough. Differences between TUV - R, TUV-B and TUV-E were discussed.

For further information about Southern California's chapter activities, contact Mr. Paul Herrick, Gradco Systems, (714) 779 1223, fax (714) 768-6939.

The next meeting of the Southern California Chapter will be held February 7, 1989, at MAl Basic Four, Inc., 14101 Myford Rd., Tustin, at 6:00 p.m. The speaker for the evening will be Serge Bousquet of the Canadian Standards Association. Serge will speak on the subject of "Harmonization of CSA 22.2 No. 220 with IEC 950." The March meeting will be held on Tuesday, March 7, 1989. The speaker for the March meeting has not yet been determined.

Area Activity Reports

Continued

Pacific Northwest Chapter
Due to the difficulty of getting members to commute from Seattle to Portland, and vice versa, finding multiple speakers with the same schedule, and finding suitable dining facilities, the officers have decided to change the way we hold meetings entirely.

From now on the Northwest Chapter will be split into two areas with consecutive meetings held in Portland and in Seattle. The two consecutive meetings will be identical, as will the speaker and the time of day. Instead of quarterly, four-hour meetings with multiple speakers, we will have monthly, one-hour meetings with one speaker. For the Portland area meetings, Pete Perkins has volunteered the Technical Center auditorium in Beaverton. For the Seattle area meetings, Walt Hart has volunteered their auditorium in Everett.

The meetings for this quarter are as follows:

- "Electric Shock," Rich Nute
  February 21, 1989, 7:00 p.m.
  Tektronix
- "Electric Shock," Rich Nute
  February 22, 1989, 7:00 p.m.
  John Fluke
- "UL in Camas," Gene Bockmier
  March 21, 1989, 6:00 p.m.*
  Tektronix
- "UL in Camas," Gene Bockmier
  March 22, 1989, 6:00 p.m.*
  John Fluke
- tbd
  April 18, 1989, 6:00 p.m.*
  Tektronix
- tbd
  April 19, 1989, 6:00 p.m.*
  John Fluke
- tbd
  May 16, 1989, 6:00 p.m *
  Tektronix
- tbd
  May 17, 1989, 6:00*
  John Fluke

* The time for the meetings may moved to 6:00 p.m., depending on a discussion we will have in our first meeting. A map will be sent out in a separate mailing for the Northwest Chapter members.

Central Texas Section Chapter
Mr. George Jurasich, a Senior Product Safety Engineer at TUV Rheinland of N.A., Inc., is heading up a new chapter in Austin, Texas. The fIrst meeting of the chapter is scheduled for March 23, 1989, at 10:00 a.m. at Sirloin Stockade Restaurant, 8820 Research Blvd., Austin, Texas. The restaurant phone number is (512) 453-1075. George reports that the first meeting will cover product changes and their impact for products subject to compliance with IEC 950. Questions about the meeting may be addressed to George Jurasich at TUV Rheinland, (512) 343-6231.

Northeast Chapter
The last meeting of the Northeast Chapter was held December 14, 1988, at DS&G. Frank McGowan from Factory Mutual spoke on "Intrinsic Safety." The next meeting will be held on January 25, 1989, again at DS&G. Bob Wersan from Panel Components will speak on the IEC Standard 320. Jim Norgaard reports that the February meeting has also been planned, with a speaker from CSA reporting on the status of power supplies at CSA. Reference will be made to CSA Bulletins 1402, versions A, B & c. The Northeast Chapter currently has approximately 216 on their mailing list and is always looking for more individuals interested in product safety. Questions about the chapter may be addressed to Jim Norgaard at DS&G, (508) 263- 2662.

Chicago Chapter
The Chicago chapter of the Product Safety Technical Committee is happy to announce its first meeting. The meeting is scheduled for March 7, 1989, at 7:00 p.m. at the following address: Mitsubishi Electric Sales America, Inc., 800 Biermann Court, Mt. Prospect, IL 60056, contact: John Allen (312) 699-4414. Mr. Stanley Savic, Director of Product Evaluation for Zenith Radio Corporation, will be their guest speaker. Mr. Savic will speak on Product Liability -- The Other Side of Quality.

Quality vs. Safety

by Manning I. Rose

The following article was published in the June 1988 *edition of the* Quality Progress Magazine *and is reprinted here with permission of the author. In the article, Mr. Rose contrasts, as a safety engineer, the broad concepts of quality with the specific responsibilities of safety.*

Quality is not equivalent to safety. Even a common discipline such as reliability is quite differ-rent in concept from safety. Some designers and product managers have mistakenly thought, "To ensure safety, we must build more reliability into our product." This simply is not true, although there is a partial, nonlinear correlation between quality and safety.

Quality assurance is concerned with reducing or eliminating product failures. Thus, quality assurance is concerned, for example, with the failure of components within products and with bugs in software programs. QA is concerned with a design's success or failure in meeting the functional specification for the product. QA is also concerned with ensuring product design engineering so that a quality product is created. Whether or not a person subscribes to the philosophy of zero defects, if zero failures could be achieved for a specific product, then the QA objectives would be met.

Product safety is concerned with those failures that result in hazardous situations. Not every product failure will result in a hazardous condition. Many product failures are customer nuisances, but will not cause an electrical shock or burn down a house. The program bugs that put software into a continuous loop may cause frustration and anger, but they are not product safety concerns. The scope of quality assurance is broader than the scope of product safety in that safety is concerned only with failures that result in the risk of a hazard.

Further, product safety is iconcerned with the effects of faults and failures that result in setting up a potential hazard. This concern is one step removed from the actual failure itself. The goal of product safety is to anticipate every possible fault condition. During a product evaluation, fault conditions are introduced one at a time to determine their effect. This is called fault effect analysis. The second pan of this goal is to study the effect of the fault condition to determine what will render the effect harmless. Quality assurance is concerned with failure analysis and fault tree analysis, while product safety is concerned with fault effect analysis.

The Three Basic Hazards

When a failure or fault condition would result in the risk of a hazard, then product safety engineering is concerned with eliminating or reducing the potential risk. There are three basic hazards with which safety is concerned: property loss risks, such as fire loss, business loss interruption, and corruption of essential data; personal accident injury and personal health injury, such as electrical shock and exposure to x-radiation; and environmental degradation, such as radio frequency interference or the results of improper disposal of PCBs from capacitors.

Product safety eliminates the effect of a failure or fault condition but does not eliminate the failure itself, because the failure condition is assumed to occur. For example, fuse protection is placed in household wiring because it is assumed a short circuit, or an overload situation such as a motor bearing wearing out, may occur. Under the fault condition, the disastrous effect of the failure is eliminated by the blowing of a fuse. The same situation is true for all types of products.

Some safety approval agencies blur the distinction by misapplying the definition of fail-safe. Interlock switches are a case in point. The international test agencies state that when an interlock switch for safety purposes fails, it must fail safely in

the off position. The conventional snap switch for Underwriters Laboratories is tested for 50 overload cycles, 4,000 normal load cycles, and 6,000 no-load cycles. The interlock switch is tested for 100,000 cycles in contrast to the approximate 10,000 cycles for a snap switch. In other words, the interlock switch is assumed to never fail because of high reliability and as being tantamount to fail-safe.

This distinction between domestic and international fail-safe definitions has led to pan of the confusion surrounding the differences between product safety and quality assurance. It is true that if there were no product faults or failures, there would be no need to consider the effect of fault conditions. With a completely reliable product, there is no need for product safety in the design, except for perhaps the human interface points where users can override the reliability.

Repeal Murphy's Law

One motto I have used to illustrate this point is "Repeal Murphy's Law." Of course, Murphy's Law can never be repealed. But like many legislative statutes, Murphy's Law can be rendered harmless by removing the teeth of the effect of the law. The fault-free product similar to zero defects is a design goal, but never can be realized. Thus, the only real solution is to render Murphy's Law completely harmless by eliminating any harmful effects of fault conditions.

Another point of confusion between quality assurance and product safety is the litigation issue surrounding products and product failure. Litigants can sue manufacturers on the basis of product warranties and also on the basis of injury. When personal injury, property loss, or environmental degradation is the issue, then the lawsuit is on the basis of design defect, improper design, or a manufacturing defect. The manufacturing defect that results in the setting up of a hazardous condition may be the result of improper quality control procedures or an improper design control procedure for product safety. The cause is of no concern to the litigant, but the manufacturer may wish to identify the cause to correct it.

Two Ways to View the Same Situation

Still another point of confusion between product safety and quality assurance is that both disciplines discuss the same materials within a product, but to a different end. QA assembles voluminous statistics on the failure rate of insulation systems and insulating materials. Product safety, on the other hand, discusses mutually exclusive failures of insulation systems in a double protection system such as double insulation. Product safety is not concerned with the rate of failure and is only slightly interested in the probability of failure. The concern is for the likelihood of two mutually independent failures occurring in such a manner as to create a hazardous condition. Product safety, therefore, is concerned with providing backup systems, like the second level of insulation, that guarantee against a fault condition.

Another blurring of the distinctions between quality assurance and product safety results from the management evolution to consider ever-widening scopes in product safety and quality. The scopes are widening from the view of a technology explosion and from the view of considering new dimensions over the traditional field of quality control. In some major organizations, the quality assurance management spans the designs within the engineering department during the product evaluation phase to determine if the new design fulfills the design specifications and objectives. In this case, quality assurance is concerned with product safety compliance with the product safety specifications as set forth by the product safety professional. Thus, QA is concerned with product failures to meet the safety specifications. Even with this very broad

Continued

management scope on the part of QA, product safety is still concerned with the effect of these product failures. While there are discrete distinctions between quality assurance and product safety, there is nonetheless the need for very close cooperation between the disciplines with respect to management and product development.

The term product evaluation is very broad and could encompass aspects from both product safety and quality assurance. Product safety is concerned with safety compliance testing and fault effect analysis. QA is also concerned with compliance testing to product specifications and failure analysis. Hence the term product evaluation tends to fade specific distinctions between QA and safety. Similarly, production line testing, the traditional domain of QA, is an area where the distinction overlaps. Here, QA tests for the functionality of the product safety systems, grounding, insulation resistance to leakage current, and dielectric strength. QA testing to determine whether a product functions as planned is different from tests for product safety determinations in compliance with safety principles.

Faults and Failures

The distinctions between quality assurance and product safety are clearly discerned when one examines the relationship of faults and failures. Product safety deals with the person-product, property-product, and environment-product interfaces in systems relationships. It is impossible to discuss product safety without the relationship being implied and understood. The term safety denotes that the product will not represent the risk of a hazard to the other party in the relationship. Quality assurance does not carry this connotation. While QA compares a component or product with specifications, standards, and implied functional requirements, there is no implied interactive relationship between the product and the comparative party other than the quality assessment.

In general, quality assurance is involved in failures, failure analysis, statistical rates of failure, and manufacturing control procedures, whether or not these involve hazards or possess an implied interface relationship. Product safety deals with effects of hazard-producing failures, risk-producing failures, fault effect analysis, and design-engineering control, with the implied and understood knowledge of an interactive relationship. QA reduces failures; product safety reduces risks of hazards.

Manning I. Rose, MA, PE, CPSM, is a product safety consultant and president of MIRA Corporation. He is an engineering professor, professional engineer, product safety consultant to NCR Corporation, and the author of many product safety articles in major engineering and quality publications. Mr. Rose is an inventor with ten patents and International Chairman of the IEC Committee that published IEC 380. Mr. Rose has been active continuously in product safety engineering for 28 *years. He conducts safety seminars and may be reached at* (513) 434-7127; *Mira Corporation, 2301 Glenheath Dr., Kettering, OH 45440-1905*

Editorial

As promised in last month's issue, some introductions are in order for the staff serving you .through the *Product Safety Newsletter.*

- Jane Benner
  Newsletter preparation
- Dave Edmunds
  "News and Notes" Editor
- Jodi Elgin
  Production Editor
- John McBain
  Assistant Editor
- John McBain (acting)
  Subscriptions Manager
- Rich Nute
  Author, "Technically Speaking"
- Richard Pescatore
  Author, "Chairman's Message"
- John Reynolds
  Editor, Technical Articles
- Annie Valva
  Desktop Publishing
- Roger Volgstadt (acting)
  Contributions Manager
- Roger Volgstadt
  Managing Editor
- Dr. Z
  Author, "Ask Doctor Z"

The above individuals are essential to the successful publication of each edition. May I suggest that if you enjoy their efforts, you write them a note, by way of the newsletter, telling them how much you appreciate their hard work? As you can see, there are some who are doing double duty. Future success of the newsletter depends a great deal on you. Anyone in any location in the country could be a great help with managing either subscriptions or contributions. Perhaps there are other ways that you would like to help. Please let me know. When several each take a small part, no one person is overloaded and everyone can have the satisfaction of participating in the beginning phases of an exciting, new international publication.

We have sent letters to those of you who have expressed interest in writing for the newsletter, explaining how to best prepare and submit your articles. Allow me to explain the process to those of you who have not contacted us. For 1989, articles for each edition are due by the first Friday of the month for the two-month period covered by the issue (Le., articles for the March/April edition are due the fIrst Friday of March). Articles should address some aspect of product safety and be limited in length to 2000 words. The newsletter staff reserves the right to edit all articles for readability, length, and grammar. We are working with the IEEE and our National officers to develop a policy on advertisements and/or contributors.

Should you have any questions or suggestions on how to improve the newsletter, please give me a call at *(408)* 748-2102.

Roger Volgstadt
Editor

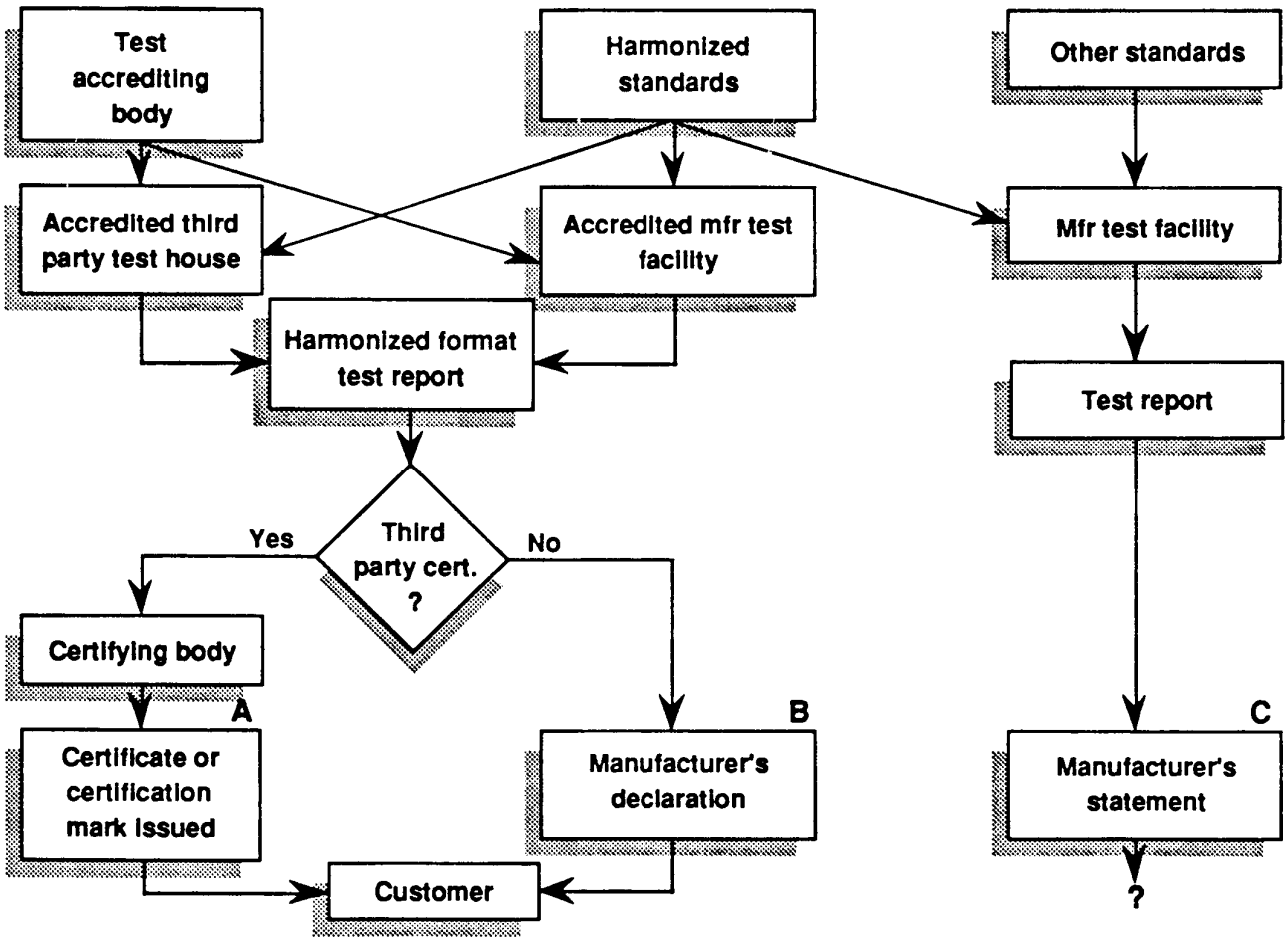
A Summary of European Regulatory Compliance for 1992

John McBain

As you probably know, 1992 in Europe means one thing: deregulation and the relaxation of trade barriers between European countries. The following flowchart shows three possible processes for investigating safety of products in Europe. Unfortunately, even if it is completely accurate now, it may not be correct in the future. Path C has a reasonable chance of becoming not just unacceptable to customers, but actually not permitted (illegal!). Path B is not especially favored by third party test houses, which have considerable influence in Europe. Stay tuned, folks! The year 1992 should be a big one for product safety.

Please keep in mind that this model is only an attempt to clarify what happens in the real world. Underlying assumptions and oversimplification may erode its utility. So, any comments on what is really going on??? Let's see some letters!

EUROPEAN CONFORMITY ASSURANCE SCHEME - 1992



NOTE: A or B will be acceptable to customers after 1992. C may not be acceptable to customers after 1992.

The Product Safety Newsletter

c/o Tandem Computers Incorporated
2550 Walsh Avenue
Santa Clara, Ca 95051
Attn: Roger Volgstadt

Calendar

The Product Safety Technical Committee of the IEEE EMC Society

Tuesday, March 7
Chicago Chapter
Subject: Product Liability---
The Other Side of Quality
Speaker: Stanley Savic
Time: 7:00 p.m.
Location: Mitsubishi
800 Biermann Court
Mt. Prospect, IL
Contact: John Allen
(312) 699-4414

Tuesday, March 7
Southern California Chapter
Speaker: TBA
Time: 6:00 p.m.
Location: MAI Basic Four
14101 Myford Rd.
Tustin, CA
Contact: Paul Herrick
(714) 779-1223

Tuesday, March 21
Pacific Northwest Chapter
Subject: UL in Camas
Speaker: Gene Bockmier
Time: 6:00 p.m. (tentative)
Locations: *Tektronix*
John Fluke (March 22)
Contact: Al Van Houd1
(206) 882-3700

Wednesday, March 22
Northeast Chapter
Subject: CSA Update
Speaker: TBA
Time: 7:00 p.m.
Location: *Sheraton Boxborough* Intersection of Rts 495/111 Boxborough, Mass
Contact: Jim Norgaard
(508) 263-2662

Thursday, March 23
Central Texas Chapter
Time: 10:00 a.m.
Location: Sirloin Stockade Restaurant
8820 Research Blvd, Austin, TX
(512) 453-1075
Contact: George Jurasich
(512) 343-6231

Tuesday, March 28
Santa *Clara Valley Chapter*
Subject: Evaluation and Testing of Power Supplies
Speaker: Jose Bravo
Time: 7:00 p.m.
Location: Apple Computer
20525 Mariani Ave. Cupertino. CA
Contact: Mike Campi
(408) 773-0770

Tuesday, March 28
Santa *Clara Valley Chapter*
Subject: Temperature Measurements in High RF Environment
Speaker: Paul Lantz
Time: 7:00 p.m.
Location: Apple Computer
20525 Mariani Ave. Cupertino. CA
Contact: Mike Campi
(408) 773-0770